

**AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claim 1 (Currently Amended): A method of simulating movement of an autonomous entity through an environment, the ~~die~~ method comprising:

providing a provisional path through a model of the environment from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path, wherein determining said preferred step comprises determining a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given speed;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether obstructions infringe said personal space; and

recording a feasible preferred step so as to allow movement of said autonomous

entity to be determined.

Claim 2 (Currently Amended): A method according to claim 1, wherein if said  
~~the~~ preferred step is not feasible, then the method further comprises:

determining a region in which to seek a compromise step and  
determining whether at least one compromise step is feasible.

Claim 3 (Currently Amended): A method according to claim 2 [[1]], comprising  
choosing one of a plurality of compromise steps.

Claim 4 (Currently Amended): A method according to claim 2 [[1]], wherein  
determining said region includes adapting step parameters for determining said region  
in dependence upon at least one locally perceivable condition.

Claim 5 (Currently Amended): A method according to claim 2 [[1]], wherein  
determining said region includes adapting step parameters for determining said region  
in dependence upon memory of past conditions.

Claim 6 (Previously Presented): A method according to claim 1, wherein the  
determining of said personal space comprises defining a region in which absence of  
obstructions is sought.

Claim 7 (Currently Amended): A method according to claim 1, wherein said obstructions include other autonomous entities.

Claim 8 (Currently Amended): A method according to claim 1, wherein said obstructions include fixed obstructions.

Claim 9 (Currently Amended): A method according to claim 1, further comprising determining said ~~the~~ inconvenience function for expressing a cost of deviating from a given direction.

Claim 10 (Currently Amended): A method according to claim 9, wherein said ~~the~~ provisional path includes a direction from said current location to said intended destination and said ~~the~~ profile includes a preferred step length, and wherein the determining of said ~~the~~ inconvenience function includes:

determining a first amount of work required to take a step of given step length;  
determining a second amount of work which is a proportion of said first amount of work corresponding to a component which is not directed in said optimal direction.

Claim 11 (Currently Amended): A method according to claim 10 ~~[[9]]~~, wherein the determining of said ~~the~~ inconvenience function includes:

determining an acceleration associated with a change in velocity between said step and a previous step and

determining a third amount of work required to produce said acceleration.

Claim 12 (Currently Amended): A method according to claim 11, wherein the determining of said ~~the~~ inconvenience function includes summing said second and third amounts of work.

Claim 13 (Currently Amended): A method according to claim 1, further comprising determining said ~~the~~ frustration function.

Claim 14 (Currently Amended): A method according to claim 13, wherein said ~~the~~ profile includes a preferred walking speed and the determining of said ~~the~~ frustration function comprises:

determining a preferred instantaneous walking speed by adding said preferred walking speed to walking speed noise;

determining an ~~a fourth~~ amount of work dependent upon a ~~difference between the~~ walking speed and said ~~the~~ preferred instantaneous walking speed.

Claim 15 (Currently Amended): A method according to claim 1, wherein the determining of said preferred step comprises:

minimising said first dissatisfaction function in respect of step length;

minimising said first dissatisfaction function in respect of step orientation;

thereby to obtain a preferred step length and a preferred step orientation.

Claim 16 (Currently Amended): A method according to claim 1, wherein the determining of whether said preferred step is feasible comprises determining a discomfort function for expressing a cost arising from said autonomous ~~the~~ entity having to keep a distance which is less than a preferred distance from an obstruction.

Claim 17 (Currently Amended): A method according to claim 1, further comprising  
providing a preferred clearance tolerance for said autonomous entity; and  
determining said ~~[[a]]~~ personal space around said autonomous entity in dependence upon said preferred clearance tolerance.

Claim 18 (Currently Amended): A method according to claim 17, further comprising:  
determining a density of neighbouring entities and  
determining said personal space around said autonomous entity in dependence upon said preferred clearance tolerance and said density of neighbouring entities.

Claim 19 (Currently Amended): A method according to claim 17, further comprising:  
providing information relating to velocity of said autonomous entity; and  
determining an angular dependency for said personal space in dependence upon

said velocity.

Claim 20 (Currently Amended): A method according to claim 1, wherein said considering of whether obstructions infringe said personal space comprises:

determining whether said personal space is infringed at a first position along said preferred step and

determining whether said personal space is infringed at a second position along said preferred step.

Claim 21 (Currently Amended): A method according to claim 20, wherein said considering of whether obstructions infringe said personal space further comprises:

determining whether said personal space is infringed at a third position along said preferred step.

Claim 22 (Currently Amended): A method according to claim 1, wherein if said the preferred step is not feasible, then the method further comprises:

determining a region in which to seek a compromise step.

Claim 23 (Original): A method according to claim 22, wherein the determining of said region comprises defining an arc.

Claim 24 (Previously Presented): A method according to claim 1, further

comprising:

determining a set of attributes for said autonomous entity in dependence upon said profile.

Claim 25 (Currently Amended): A method according to claim 24, wherein the determining of said set of attributes ~~at least attributes~~ comprises:

determining at least one attribute at a time of generating said autonomous entity.

Claim 26 (Original): A method according to claim 24, further comprising:  
modifying at least one attribute of said set of attributes for said autonomous entity.

Claim 27 (Previously Presented): A method according to claim 1, wherein providing said profile for said autonomous entity comprises:

basing said profile on a set of measured attributes.

Claim 28 (Previously Presented): A method according to claim 1, wherein providing said profile for said autonomous entity comprises:

statistically assigning said profile.

Claim 29 (Previously Presented): A method according to claim 1, wherein providing said profile for said autonomous entity comprises:

providing said profile in dependence upon at least one aspect of said environment.

Claim 30 (Currently Amended): A method according to claim 1, wherein providing said provisional path through said model of the environment from said current location to said intended destination comprises:

determining a bearing ~~beating~~ from said current location to said intended destination.

Claim 31 (Currently Amended): A method according to claim 1, further comprising:

providing a preferred clearance tolerance for said autonomous entity; and  
determining said personal space around said autonomous entity in dependence upon said preferred clearance tolerance.

Claim 32 (Currently Amended): A method according to claim 31, comprising:  
determining a density of neighbouring entities and  
determining said personal space around said autonomous entity in dependence upon said preferred clearance tolerance and said density of neighbouring entities.

Claim 33 (Currently Amended): A method according to claim 31, comprising:  
providing information relating to velocity of said autonomous entity; and  
determining an angular dependency for said personal space in dependence upon said velocity.



Claim 34 (Previously Presented): A method of designing a building structure, the method comprising:

providing a model of said building structure;

simulating movement of at least one autonomous entity through said building structure, ~~according to claim 1~~; and

revising said model of said building structure in dependence upon movement of said at least one autonomous entity, wherein the simulating of the movement comprises:

providing a provisional path through said model of the building structure from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path, wherein determining said preferred step comprises determining a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given speed;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether obstructions infringe said personal space; and

recording a feasible preferred step so as to allow movement of said autonomous

entity to be determined.

Claim 35 (Previously Presented): A method according to claim 1, further comprising:

determining said preferred step towards said intended destination while minimising deviation from a preferred speed.

Claim 36 (Previously Presented): A method according to claim 1, further comprising:

determining ~~selecting~~ said preferred step towards said intended destination while maintaining at least a minimum distance from obstacles.

Claim 37 (Previously Presented): A method according to claim 1, further comprising:

defining a neighbourhood;  
scanning said neighbourhood for obstacles;  
determining at least one condition relating to said obstacles and  
defining an area in which to seek a step towards said destination in dependence upon said at least one condition.

Claim 38 (Currently Amended): A method of simulating movement of an autonomous entity through an environment from a current location to an intended

destination, the method comprising:

providing a provisional path through a model of the environment from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether obstructions infringe said personal space; [[and,]]

recording a feasible preferred step so as to allow movement of said autonomous entity to be determined; and

if said preferred step is not feasible, determining a compromise step, wherein determining a compromise step includes:

defining a neighbourhood;

scanning said neighbourhood for obstacles;

determining at least one condition relating to said obstacles and

defining an area in which to seek a step towards said destination in dependence upon said at least one condition.

Claim 39 (Previously Presented): A method according to claim 37, wherein determining said at least one condition relating to said obstacles comprises:

determining a density of one type of obstacle.

Claim 40 (Currently Amended): A method according to claim ~~any one of claims~~ 37, wherein defining said area in which to seek a step towards said destination comprises:

establishing an angular range for a search.

Claim 41 (Previously Presented): A method according to claim 37, wherein defining said area in which to seek a step towards said destination comprises:

determining to which side of a preferred direction to search.

Claim 42 (Currently Amended): A computer program tangibly embodied on a computer-readable medium, the computer program comprising computer executable instructions for ~~a performing the method according to claim 1~~ of simulating movement of an autonomous entity through an environment, the method comprising:

providing a provisional path through a model of the environment from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path, wherein determining said preferred step comprises determining a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given

speed;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether  
obstructions infringe said personal space; and

recording a feasible preferred step so as to allow movement of said autonomous  
entity to be determined.

Claim 43 (Currently Amended): A computer-readable medium storing a the  
computer program ~~of claim 42~~ comprising computer executable instructions for a  
method of simulating movement of an autonomous entity through an environment, the  
method comprising:

providing a provisional path through a model of the environment from a current  
location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said  
profile and said provisional path, wherein determining said preferred step comprises  
determining a first dissatisfaction function for expressing a cost of taking a step  
comprising a sum of an inconvenience function for expressing a cost of deviating from a  
given direction and a frustration function for expressing a cost of deviating from a given  
speed;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether

obstructions infringe said personal space; and

recording a feasible preferred step so as to allow movement of said autonomous entity to be determined.

Claim 44 (Currently Amended): Apparatus configured to perform a the method according to claim 1 of simulating movement of an autonomous entity through an environment, the method comprising:

providing a provisional path through a model of the environment from a current location to an intended destination;

providing a profile for said autonomous entity;

determining a preferred step towards said intended destination based upon said profile and said provisional path, wherein determining said preferred step comprises determining a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given speed;

determining a personal space around said autonomous entity;

determining whether said preferred step is feasible by considering whether obstructions infringe said personal space; and

recording a feasible preferred step so as to allow movement of said autonomous entity to be determined.

Claim 45 (Original): Apparatus for simulating movement of an autonomous entity through an environment, the apparatus comprising:

means for providing a provisional path through a model of the environment from a current location to an intended destination;

means for providing a profile for said autonomous entity;

means for determining a preferred step towards said intended destination based upon said profile and said provisional path; said determining means configured to determine a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given speed;

means for determining a personal space around said autonomous entity;

means for determining whether said preferred step is feasible by considering whether obstructions infringe said personal space.

Claim 46 (Currently Amended): Apparatus for simulating movement of an autonomous entity through an environment, the apparatus comprising:

means for providing a provisional path through a model of the environment from a current location to an intended destination;

means for providing a profile for said autonomous entity;

means for determining a preferred step towards ~~towards~~ said intended destination based upon said profile and said provisional path;

means for determining a personal space around said autonomous entity;  
means for determining whether said preferred step is feasible by considering whether obstructions infringe said personal space and, if said preferred step is not feasible, for determining a compromise step,

wherein said means for determining a compromise step includes:  
means for defining a neighbourhood;  
means for scanning said neighbourhood for obstacles;  
means for determining at least one condition relating to said obstacles; and

means for defining an area in which to seek a step towards said destination in dependence upon said at least one condition.

Claim 47 (Currently Amended): Apparatus for simulating movement of an autonomous entity through an environment, the apparatus comprising:

an interface for providing a provisional path through a model of the environment from a current location to an intended destination and[[;

an interface]] for providing a profile for said autonomous entity;

a processor for determining a preferred step towards said intended destination based upon said profile and said provisional path, wherein said processor is configured to determine a first dissatisfaction function for expressing a cost of taking a step comprising a sum of an inconvenience function for expressing a cost of deviating from a given direction and a frustration function for expressing a cost of deviating from a given



speed;

said ~~[[a]]~~ processor ~~for~~ determining a personal space around said autonomous entity; and

said ~~[[a]]~~ processor ~~for~~ determining whether said preferred step is feasible by considering whether obstructions infringe said personal space.

Claim 48 (Currently Amended): Apparatus for simulating movement of an autonomous entity through an environment, the apparatus comprising:

an interface for providing a provisional path through a model of the environment from a current location to an intended destination and[[;

an interface]] for providing a profile for said autonomous entity;

a processor for determining a preferred step towards said intended destination based upon said profile and said provisional path<sub>1</sub>[[;]]

~~a processor~~ for determining a personal space around said autonomous entity, and[[;]]

~~a processor~~ for determining whether said preferred step is feasible by considering whether obstructions infringe said personal space and, if said preferred step is not feasible, for determining a compromise step,

wherein said processor is configured define a neighbourhood, scan said neighbourhood for obstacles, determine at least one condition relating to said obstacles; and define an area in which to seek a step towards said destination in dependence upon said at least one condition.